

REMARKS

By this amendment, Applicants have amended claims 3-6 to be in independent form by including therein all of the limitations of claim 1, from which claims 3-6 previously depended. Claim 1 has been canceled without prejudice or disclaimer and claim 2 amended to depend from claim 3. Applicants have also added claims 11-13 (corresponding to claim 2) but dependent on claims 4-6, respectively.

Claims 1-3, 5 and 6 stand rejected under 35 U.S.C. 102(b) as allegedly being anticipated by U.S. Patent number 3,282,495 to Walls or Japanese patent application publication number 04-358787 (JP '787) to Yoshimura et al. Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to a screw compressor that includes a casing and male and female rotors formed with axially twisted screw grooves accommodated in the casing. The rotors are rotated by timing gears fixed to the respective rotors while a desired minute gap is kept therebetween. The respective rotors include concave stripes having a minute depth and provided on respective screw grooves to extend along directions of twist thereof. The concave strips reduce leakage of compressed air and provide a high compression efficiency.

Independent claims 3 and 4 define the respective widths and pitch spaces of some of these grooves. Independent claim 3 recites that the respective widths of the concave stripes and pitch spaces between adjacent concave stripes are smaller in those regions in which curved surfaces of the both rotors comprise a combination of a convex surface and a convex surface than those regions in which curved surfaces of the both rotors comprise a combination of a convex and a concave surface. Independent claim 4 specifies that the concave stripes at bottoms of the screw

grooves on the male rotor are smaller in respective widths thereof and pitch spaces between adjacent ones than those on other portions of the bottoms.

Independent claim 5 recites that the screw compressor includes means for increasing fluid resistance against air provided on the concave stripes in those regions in which a movement path of a minimum portion of a minute gap formed between the both rotors at the time of rotation of both rotors intersects the concave stripes. Independent claim 6 recites that the surfaces of the concave stripes are roughened in those regions in which a movement path of a minimum portion of a minute gap formed between the both rotors at the time of rotation of the both rotors intersects the concave stripes.

The features set forth in independent claims 3-6 are neither disclosed nor suggested by Walls or JP '787.

The Walls patent relates to fluid pumps, motors and compressors, and, more particularly, to a sealing arrangement for a screw-type compressor. This patent discloses incorporating a replaceable, elongated wearable sealing strip in the parametric tip or outer land portion of each thread of the rotors. The seal strip is sufficiently sturdy and rigid to withstand normal forces encountered due to pressure differentials, centrifugal forces, dirt impingement and handling, and is flexible enough to conform to the contour of the surface to which the strip is mounted. The seal strip preferably comprises a honeycomb cell structure secured to a suitable base or backing, the complete strip being inserted in a predetermined slot in the tip of the thread. In Walls, the sealing strips 50 are mounted in the slots 57 formed in the tip portions of the threads 40-46 of the rotors 30-31. The sealing strips are provided to reduce leakage from the gap between the rotors 30, 31 and the housing 11 by narrowing the gap.

The Examiner apparently interprets the sealing strips 50 of Walls to be the equivalent of the concave stripes of the present invention. However, neither the sealing strips 50 of Walls nor the slots 57 in which they are mounted have the characteristics set forth in claims 3-6.

While alleging claim 3 to be anticipated by Walls, the Examiner provides no guidance as to where she believes the features of claim 3 are disclosed in Walls. Applicants submit that the Walls patent does not disclose the concave stripes presently claimed wherein the respective widths of the concave stripes and pitch spaces between adjacent concave stripes are smaller in those regions in which curved surfaces of the both rotors comprise a combination of convex surface and a convex surface than in those regions in which curved surfaces of the both rotors comprise a combination of a convex surface and a concave surface, as set forth in claim 3. That is, varying the widths and pitch spaces is neither disclosed nor suggested by Walls.

With respect to claims 5 and 6, the Examiner mentions the Iguchi et al. patent. It is not clear how the Examiner is applying the Iguchi et al. patent, especially since the rejection in numbered section 2 of the Office Action is under 35 U.S.C. 102(b) not 103. In any event, neither Walls, JP '787, nor Iguchi et al. would have suggested the features of claims 5 and 6, that is, means for increasing fluid resistance against air or a roughening provided on the concave stripes in those regions in which a movement path of a minimum portion of mutant gap formed between the both rotors at the time of rotation of the both rotors intersects the concave stripes. Again, these features are neither disclosed nor suggested by Walls, JP '787 or Iguchi et al.

In JP '787 (Yoshimura et al.), multiple seal edges 4 are provided on the drive side tooth faces F1 and M1 at positions where the seal edges 4 are not made in

contact with those on the mating rotors during the rotation. Again, the features set forth in independent claims 3-6 are neither disclosed nor suggested by Yoshimura et al. Specifically, bearing the widths of and pitch spaces between adjacent concave stripes as set forth in claim 3 are neither disclosed nor suggested by Yoshimura et al. Moreover, the means for increasing fluid resistance or roughening set forth in claims 5 and 6 are neither disclosed nor suggested by Yoshimura et al.

According to investigations made by Applicants, it has been confirmed that, even when a mutant gap between the male and female motors is the same, the combination of a convex surface and a convex surface shown in Figure 14a brings about a greater leakage air than that in the combination of a concave surface and a convex surface shown in Figure 14b. This tendency is unchanged even when the curvatures of the concave surface and convex surface are changed. Locations indicated by the circle B in Figure 13a and the circles C and D in Figure 13b, in which there is a large leakage of air, correspond to regions at bottoms of the screw grooves. Applicants have found that, in order to decrease leakage of air in these regions, the width of the concave stripes and the pitch space between adjacent concave stripes should be reduced to increase the fluid resistance. See, page 21, line 24 to page 22, line 16 of Applicants' specification. These features, as set forth in claims 3 and 4, are neither disclosed nor suggested by Walls or Yoshimura et al.

Applicants have also found that it is desirable to prevent air from leaking laterally in regions in which the seal line intersects the concave stripes. This can be achieved by providing means for increasing the fluid resistance against air flow, e.g., a roughened surface, in such regions, i.e., in those regions in which a movement path of a minimum portion of a minute gap formed between the both rotors at the time of rotation of the both rotors intersects the concave stripes. See page 25, line 4

to page 27, line 22 of Applicants' specification. These features, as set forth in claims 5 and 6, are neither disclosed nor suggested by Walls or Yoshimura et al.

For the foregoing reasons, the presently claimed invention is patentable Walls or Yoshimura et al.

Claim 4 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshimura et al. "in view of design choice." In support this rejection, it has been urged by the Examiner that one of ordinary skill in the art "would have found it obvious to utilize the size of the concave stripes at bottoms of the screw grooves on the male rotor and the size of the pitch spaces, since they are merely design parameters, depending on the design variables such as the load applied to the screw compressor and the viscosity of the lubricating fluid." Applicants traverse this rejection and request reconsideration thereof.

Claim 4, however, recites that the concave stripes at bottoms of the screw grooves on the male rotor are smaller in respective widths thereof and pitch spaces between adjacent ones than those on other portions than the bottoms. Clearly this is neither disclosed nor suggested by Yoshimura et al. Moreover, simply stating that this feature is a matter of a "design choice" is not the objective evidence and specific factual findings necessary with respect to the necessary teaching of motivation to modify the prior art. *In re Lee*, 277 F3d 1338, 1342-44, 61 USPQ 2d 1430, 1433-34 (Fed. Cir. 2002); *In re Fine*, 837 F2d 1071, 5 USPQ 2d 1596 (Fed. Cir. 1986).

The Examiner also alleges that there is nothing in the record which establishes that the features set forth in claim 4 present a novel or unexpected result. In the first place, however, it is not necessary for Applicants to demonstrate unexpected results until the Examiner's demonstrated a *prima facie* case of obviousness. It has submitted the Examiner has not demonstrated a *prima facie*

case of obviousness without pointing to any motivation to modify the teachings of Yoshimura et al. to arrive at the presently claimed invention. Moreover, making the widths of and the pitch spaces between concave stripes at bottoms of the screw grooves on the male rotors smaller than those on the other portions of the bottoms does provide the unexpected result of reducing air leakage as described at page 21, line 24 to page 22, line 16 of Applicants' specification.

For the foregoing reasons, claim 4 is patentable over Yoshimura et al.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all of the claims now in the application are requested.

To the extent necessary, applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 500.42876X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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